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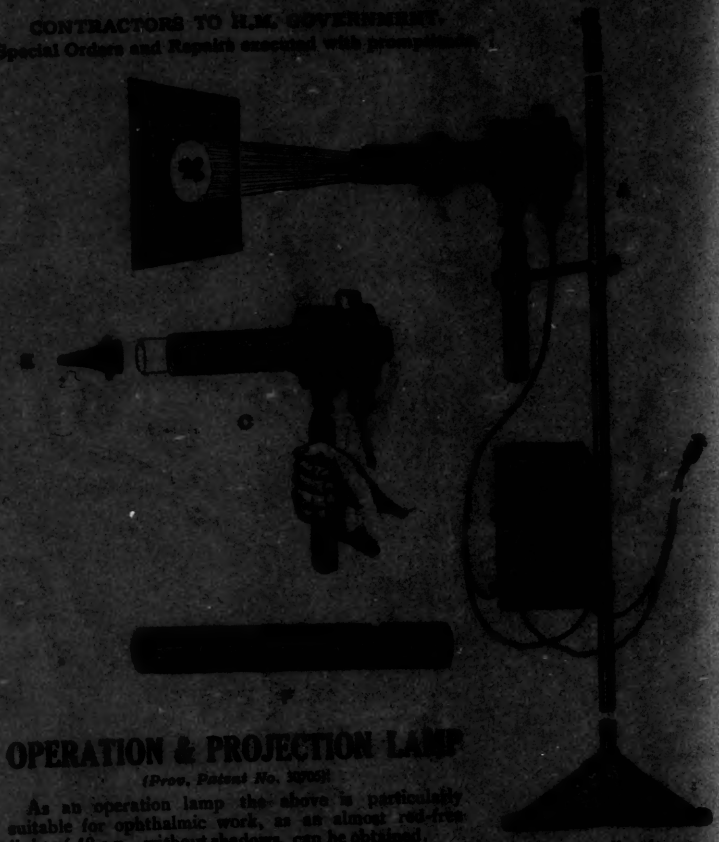

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THE BRITISH JOURNAL

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OPHTHALMOLOGY

FEBRUARY, 1925

COMMUNICATIONS

THE RELATIONS BETWEEN EYE MOVEMENTS AND OTHER CRANIAL MUSCLES

BY

E. ARNOLD CARMICHAEL AND MACDONALD CRITCHLEY

LONDON

THE earliest and best known example of a movement associated with contraction of extrinsic eye or eyelid muscles is the jaw-winking reflex carefully described by Marcus Gunn and others. Kinnier Wilson has since drawn attention to an associated movement of the ear and eye muscles, and Stannus has added an interesting contribution on this subject.

In a recent clinical investigation at the National Hospital, Queen Square, we have noted six types of associated movements which may occur singly or combined. Each of these types will be considered briefly.

If the eyes be fully deviated laterally, the helix of each pinna becomes rotated backwards and inwards towards the mastoid. This movement is slow and deliberate; it is a bilateral phenomenon with a wider excursion occurring in the contralateral ear. This we have termed the oculo-aural movement.

In many people it is possible to demonstrate a depression of the contralateral eyebrow and a raising of the homolateral eyebrow on deviating the eyes laterally. To this we have assigned the name oculo-frontalis movement.

We have observed that the point of the tongue may turn over to the homolateral side in deviation of the eyes. This movement we have designated the oculo-lingual.

Furthermore, in our investigation we have had the opportunity of observing and demonstrating satisfactorily the presence of an oculo-mandibular movement. If the eyes be rapidly deviated to one and then the other side, a protrusion and deviation of the mandible to the contralateral side occurs.

In a previous paper we have placed on record two cases demonstrating a relation between the stapedius muscle and the eyes. Both these cases suffered from unilateral blepharospasm, and complained of a buzzing noise in the homolateral ear. For brevity we refer to this as the orbiculo-stapedial movement.

In one case an oculo-nasal movement was observed consisting of dilatation of the nostrils on extreme deviation of the eyes.

It is not necessary to enumerate here the various muscles and their nerve supply, but the wide distribution of the cranial nerves involved should be emphasized. An observation of anatomical interest arises at this point. No case suffering from an ocular palsy exhibited these movements; but in a case with a complete facial paralysis involving the taste fibres to the tongue, the movements of the ear on the paralyzed side were still present. This at once suggests that the innervation of the intrinsic ear muscles may be other than by the 7th nerve. The possibility has been brought to our notice that embryologically these muscles derive their supply from the 5th nerve. If so, it simplifies the anatomical arrangements considerably as the 3rd, 4th, 5th, and 6th nerves are supposed to have a common mesoblastic origin in the premandibular portion of the foetal embryo.

The nature of these associated movements is not at first sight evident. Are they pathological manifestations, indicating an abnormal nerve supply to the cranial musculature? This hypothesis has been suggested in explanation of the jaw-winking phenomenon—the levator palpebrae in these cases being presumed to have an innervation from the 5th nerve. Are the movements, on the other hand, reflex in character? Could active contraction and relaxation of the eye muscles or alteration in posture constitute the afferent side of a reflex arc, causing movement of the ear, jaw, tongue, or nares? If this were so, these phenomena would be brought into line with the tonic neck reflexes of Magnus and de Kleijn. The selective nature of the motor response, its slow rate of manifestation, and its ready fatiguability are points against this view. Neither is it possible to regard these movements as instances of facial tics, the inability of the subject voluntarily to reproduce the retraction movement of the pinna precluding this hypothesis. The possibility remains, therefore, that these

phenomena are "associated movements"—vestigial in origin, and relics of purposive and more specialized movements which are to be found in the animal kingdom. Referring to the jaw-winking phenomena again, Harman favours a phylogenetic origin and refers to the fact that in certain fishes the pterygoid and orbicularis are in close anatomical association.

An investigation into the facial and ocular movements in various animals supports the theory of phylogenetic origin. Their presence or absence depends apparently upon the mode of life of the animals with the resulting anatomical adaptations. Thus, among the carnivora and animals preyed upon by larger beasts, or those living a solitary existence, the sense of smell and of hearing is far more specialized than that of sight. In consequence we find high grade external nasal and aural appendages capable of every kind of independent and voluntary movement. The eyes, on the contrary, are movable through an extremely small range so that in order to look sideways the animal is compelled to turn its head and neck. Mounting higher in the anatomical scale, we find that as the animal becomes more observant, it learns to depend less upon smell and hearing, and the external organs of these senses dwindle and become less mobile. The eyes, however, become more and more under control of the will and are capable of wider ranges of movement: such animals are exemplified by the higher primates—chimpanzees and orangs—and in these the oculo-aural movement is well seen. The phenomena, therefore, would appear to be a device whereby the senses of sight and hearing are simultaneously brought to bear upon an object. In man, who depends far more than the monkey upon his visual acuity, the oculo-aural associated movement dwindles and is no longer a well-marked and constant phenomenon.

The oculo-frontalis movement of man is also met with amongst animals—particularly those with long tufts of hair about the head and eyebrows. This suggests that the movement is a device for retracting the hair from the field of vision.

Reference has been made to a possible association between contraction of the orbicularis and of the stapedius. Although the exact function of the latter muscle in regard to the appreciation of high tones is not clear, certainly one of its actions is to deaden loud and raucous noises. This may, therefore, explain the familiar screwing up of the eyes when a shrill and unpleasant noise is heard, the object being perhaps to damp down some of the tympanic vibrations. It is probable, moreover, that the stapedius also picks up and intensifies subdued tones; the familiar deviation of the eyes to one side or the other when listening for a very quiet sound may therefore be a mechanism whereby the stapedius muscle is rendered tense. This oculo-aural association is best studied

phylogenetically amongst the reptilia—creatures possessing no external ear but having a wide range of eye movement, each eye independent of the other. If a note is blown upon a Galton's whistle just behind a chameleon, the animal immediately deviates its eyes in that direction, as though to intensify the sound, and later slowly turns its head and neck and advances sluggishly towards the whistle.

So far as our investigations have gone, we have not observed in animals any instances of tongue or snout movement associated with deviation of the eyes.

Facial Nystagmus

Analagous to these associated movements, we have observed in many cases of disseminated sclerosis a nystagmus of various facial muscles, arising only when the eyes are deviated laterally. Five cases exhibiting ocular nystagmus showed in addition a synchronous retraction-relaxation of the pinna. This "nystagmus of the ear" was sustained just as long as one maintained lateral ocular deviation.

In many cases of disseminated sclerosis, a vertical nystagmoid movement of the homolateral eyebrow was observed on lateral deviation of the eyes. In a large proportion of these cases there was no ocular nystagmus whatever; in such instances, therefore, frontalis nystagmus becomes of diagnostic importance.

In one case of disseminated sclerosis, a nystagmoid movement of the right-hand corner of the mouth was observed when the eyes were deviated to one side or the other: this movement was apparently due to a rapid contraction-relaxation of the levator anguli oris, and was more marked when the eyes were turned away from that muscle.

It is difficult, in the absence of pathological evidence, to state definitely the nature of facial nystagmus. Every one of our cases has been observed in pathological states, and it is probable that the question of causation is closely bound with the problem of ocular nystagmus. Whether these cases of ours exhibited associated oculo-aural or oculo-frontalis movements prior to the onset of nystagmus is of course impossible to tell, but it seems feasible that facial nystagmus is really an incoordinated facial associated movement.

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THE SPECIAL VULNERABILITY OF THE MACULAR FIBRES AND "SPARING OF THE MACULA"

BY

H. M. TRAQUAIR

EDINBURGH

IT is widely believed amongst ophthalmologists that the macular fibres in the visual path, especially in the optic nerve, are much more liable to disease than those which correspond to the retinal periphery, and also, though doubtless with fewer adherents and somewhat more reserve, that each macula is connected with both cortical visual centres so that when one is destroyed full central vision may still be preserved. The former hypothesis is based upon the study of the symptoms of retrobulbar neuritis and toxic amblyopia in which central scotoma is a characteristic feature, the latter on the study of occipital hemianopias of vascular origin in which " sparing" of the fixation point is the rule.

It is not easy to see why there should be special vulnerability below the geniculate ganglion and special immunity above it, and it may be of interest to review the subject in the light of our present knowledge.

With regard to the retina it may be concluded that the macular area, being constantly directed towards illuminated objects, is more exposed to light and to variations in light than other parts of the retina and that, therefore, metabolism is more active and more constant in this area. On these grounds the macula might be expected to show signs of wear at a relatively early stage. That some cases of macular disease result from causes of this kind may not be impossible, but if such causes were of any importance the incidence of macular disease amongst those whose work requires the constant use of closely applied central vision would surely be greater than it is. It can hardly be denied, however, that certain forms of disease of the central visual elements appear to support the hypothesis of special vulnerability, but when we examine the evidence closely it becomes clear that while the central elements as a whole are easily affected it is by no means always those whose physiological function is most highly elaborated which suffer soonest or most severely.

Frequently the paracentral or parafoveal elements are mainly involved. In many cases of central choroido-retinal disease the ophthalmoscopic appearances suggest gross and severe lesions and yet central vision remains relatively good. If the scotoma in such cases is carefully analyzed, it will often be found that small areas of practically absolute blindness are situated here and there

around the fixation point, perhaps partly invading it, but that central vision itself may remain but little affected for long after paracentral vision has failed in patches. Not infrequently a definite small ring scotoma can be discovered in such cases, encircling an area of comparatively good vision. Ring scotoma occurs in both retinal and optic nerve disease and the central seeing area may be quite small.

The occurrence of ring scotoma in choroido-retinal and nerve disease suggests that the incidence of the injury to the nerve elements is determined by causes quite other than functional activity, and the same may be said in respect of conditions characterized by early peripheral visual loss such as tabetic and post-oedematous atrophy, retinitis pigmentosa, glaucoma, and others. With regard to the effects of toxins the different results produced by different poisons seem incapable of any other explanation than that of selective affinity. Some toxic substances cause defects chiefly in the central parts of the field, others in the periphery, and in the former group there seems to be little or no special predilection for the exact central elements whether cells or fibres. This is most clearly demonstrable in the case of tobacco poisoning in which the slow development of the visual interference enables its primary incidence and progress to be accurately ascertained. The nerve elements related to the area between the papilla and the macula seem to be very susceptible, and the common and important centro-caecal type of scotoma is expressive of this weakness. This defect may occur in tobacco poisoning and in retrobulbar neuritis from various causes. In tobacco poisoning the intense part of the defect is never central through in advanced cases the fixation point may become for a time overlapped by the edge of the area of most intense blindness. In various forms of retrobulbar neuritis with a centro-caecal defect, the conditions are somewhat similar though here the foveal area often suffers more severely and the scotoma may be large and dense throughout. Moreover, in bilateral cases the defects are sometimes different on the two sides, being chiefly central in one field and peripheral in the other.

In the more acute forms of central toxic defect the incidence is not yet definitely known, and until evidence can be obtained from the examination of the earliest stages of such conditions we are not entitled to believe that the susceptibility of the nerve elements is governed by their function. Again, the observation of central defects during recovery frequently shows that the fixation area is not the last part to be restored. Paracentral defects of considerable intensity may remain after the restitution of normal central vision. In retrobulbar neuritis it may sometimes be observed that, after a period of slow and slight improvement, a

rapid access of central vision occurs. If the field be tested at this time the explanation will often be found in the presence of a ring scotoma, central vision having emerged through the former large scotoma as a mountain peak protrudes through mist. The recovery of central vision may be very slow, it may occur after a year or more, a result hardly to be expected if the central elements were anything but highly resistant. As the visual path passes centralwards the conditions under which visual loss occurs change. In the optic nerve retrobulbar neuritis of various kinds and damage caused by endogenic and exogenic toxins are the usual causes of conduction interference, pressure and vascular disease being comparatively uncommon. It is of interest to note that the condition or group of conditions included under the term retrobulbar neuritis, which is such a frequent cause of central scotoma, is almost confined to that part of the nerve path which is provided with a skeleton of fibrous trabeculae, *i.e.*, the optic nerve. In the chiasma and tracts the direct action of toxins almost disappears and the liability to disease is accordingly considerably less than in the subchiasmal path. Tumour pressure, acting through the medium of the circulation, syphilis and multiple sclerosis are the chief causes of chiasmal or tract interference. At this level lesions produce hemianopia and the dividing line between the seeing and the defective half fields passes either vertically through the fixation area or skirts round it into the defective half field. In the latter case there is said to be "sparing of the macula," more correctly, sparing of the fixation area. In chiasmal and tract lesions sparing of the fixation area is frequent though not so common as in supragenículate lesions. The sparing may be small in amount and relative, *i.e.*, present for large objects and absent for colours or small stimuli, and the amount of sparing may vary from time to time or differ on the two sides. In certain tumour cases where the sparing was absent it has been found to appear after relief of pressure by operation. In complete blocking or destruction of the tract there is no sparing. In the supragenículate part of the pathway the nature of the cause of visual loss changes again. Vascular lesions resulting in diminution or cessation of blood supply become prominent, also pressure from tumours, abscesses, or haemorrhage near though not involving the visual elements. Direct toxic interference or anything comparable to the "neuritis" of the subchiasmal path does not appear to occur. Sparing of the fixation area is the rule. Only in wounds, in which actual destruction by trauma of the macular cortical centre or its fibres can take place, is division of the fixation area at all common. In certain vascular lesions, however, the macular area may be divided and in the case of tumours which gradually compress the radiations the fixation area may be spared at first

and divided later. The latter observation forms the basis of the view advocated by Lenz that at a point in the optic radiation near the boundary between the parietal and occipital lobes a bifurcation of the central fibres takes place so that both sides of each macular area are connected with each occipital centre. Interference in front of this point is likely to involve the whole radiation and Lenz has shown that division of the fixation area is more common in anterior hemianopias.

In occipital vascular lesions sparing of the fixation area is the rule at the time when the field is examined but it is sometimes absent or only relative, while sometimes it is absent at first and appears later. It is probable that, if every case of vascular occipital hemianopia could be examined at the earliest moment that perimetry is possible, division of the fixation point would be more frequently found.

Lastly, we may note that hemianopic central scotomata may occur due to occipital lesions of vascular type; here the fixation area is divided and recovery does not occur. These scotomata are similar to those produced by wounds and are evidently due to a direct lesion of the macular elements.

If we review the genesis of central scotomata due to nerve lesions it becomes evident that they are much more likely to be produced by lesions of the anterior than of the posterior part of the visual path, while sparing of the fixation area becomes more common the more posteriorly the lesion is situated. We have also seen that the nature of the lesion varies with the part of the path affected.

Involvement of the central fibres is common where the nerve path is concentrated and more infrequent where the fibres are spread out and in no case is there evidence that those elements which are hardest worked or functionally most highly evolved are specially liable to suffer.

In the subgeniculate pathway it is of interest to note that the acuity of the lesion appears to predispose to central interference. This is most noticeable in the case of pressure interference with the chiasma. Slowly growing or stationary pituitary tumours, as in chronic acromegaly, are associated with bitemporal hemianopic defects without central scotomata, whereas actively growing tumours or inflammatory processes practically always produce pronounced central defects. In the optic nerve this feature is less marked, but while all the acute changes are characterized by central scotoma, most of the more chronic processes, such as slowly advancing tabetic atrophy and post-neuritic atrophy from intracranial pressure, are distinguished by its absence.

The most satisfactory explanation of sparing of the fixation area in occipital vascular lesions is that advocated by Lister and

Holmes, *i.e.*, that it is due to survival of the cortical macular area owing to its potential double blood supply from the middle as well as from the posterior cerebral artery. Henschen has also pointed out that the optic radiation in its posterior part receives deep twigs from the middle cerebral artery. The terminal branches of these arteries anastomose freely in the pia mater, but the penetrating twigs are end arteries. In this way initial division of the fixation area followed by sparing is easily accounted for, and isolated homonymous hemianopic scotomata may be explained on the assumption that the block has occurred in one or several penetrating twigs distal to the pial anastomosis.

The functional superiority of the macular neurones also suggests that a greater degree of interference may be required to put them completely out of action, whether it is caused by vascular disease or by pressure on the radiation by a tumour. For these reasons it seems unnecessary to postulate a double cortical representation for the macular area although this hypothesis is advocated by such recognized authorities as Wilbrand and Saenger. As regards central scotomata it would appear that the macular cells and fibres are in reality extremely resistant, and that their liability to interference depends upon anatomical and circulatory conditions and on selective affinities for toxins rather than upon functional relationships.

A SERIES OF 250 CATARACT EXTRACTIONS BY BARRAQUER'S METHOD*

BY

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THE method of removing the cataractous lens in its capsule by means of a suction apparatus, as perfected by Barraquer, attracted a large amount of attention throughout the ophthalmological world shortly after it was described and demonstrated. As in numerous other clinics the method was put on its trial here as soon as practicable.

In 1922-23 a series of 250 cases was completed. The operations did not run consecutively but parallel with the routine "Madras" operation (primary capsule rupture with complete iridectomy) and

* From material collected for and included in the Annual Report of the Superintendent, Government Ophthalmic Hospital, Madras for 1922.

a series of "Simple" operations. The tabular statement shows this Barraquer series compared with 1,279 other operations done in 1922. The results are classed as they usually are in this clinic:

	"Successes" 6/36 and better	"Partial successes" 6/36 to 2/60	"Partial failures" 2/60 to H.M.	"Failures" less than H.M.	"Untested"	Total	Vitreous losses
"Simple" followed by eserin ...	370	25	10	1	—	406	4
Primary capsule rupture with iridectomy and atropin ...	754	64	45	8	2	873	19
Barraquer's operation ...	201	22	20	6	1	250	23

It may be seen that the results are very much worse than in the case of our ordinary capsulotomy method, but this is hardly a fair comparison. A definite opinion on the value of any method of cataract operating cannot be formed on such a series as this, and it was obvious that the later results tended to become better. One got the impression, however, that phakoeresis is probably more valuable than any other method yet introduced for the removal of the lens in its capsule in selected cases, but there is a large number of cases in which the method is inapplicable. It will hardly give a sufficiently high percentage of "operative" successes to justify its adoption in the following types of cases:

(*a*) A markedly bulging eye.

(*b*) A friable capsule.

(*c*) An immature cataract with a normal suspensory ligament.

(*d*) A Morgagnian cataract.

Other more uncommon types too might be enumerated in which it would be infinitely wiser not to use the method, and in so far as the "operative" and "immediate post-operative" results are concerned it is still beyond doubt that the surgeon must select his operation according to the case and not allow himself to be tied down to any particular method even though he prefers a certain type of operation for the general run of his cases.

In my experience one of the most important pitfalls into which the beginner is liable to stumble is allowing the cup to become engaged in the iris. It is absolutely essential that the pupil should

be fully dilated, or an iridectomy be done, if the operator has any difficulty in applying the cup to the anterior capsule. I have frequently found difficulty in keeping the cup clear of the pupillary border either in cases where full dilatation was not obtained or in cases where the iris contracted as the result of making the section. It may here be mentioned that many of our cases dilate to a very limited extent with the usual pre-operative instillations of atropin 1 per cent. Such cases are not suitable for Barraquer's operation without iridectomy. When, with Barraquer's method, a perfect delivery is effected through a non-injured pupil, and negative pressure is established subsequent to delivery with complete reposition of the pupil, one may consider that the most perfect "operative" result has been achieved in so far as the intra-capsular method is concerned. If, thereafter, the "immediate post-operative" period is gone through without mishap, that is to say that without an iris prolapse the section heals, the chamber forms, and we get a round active pupil, the same may be said of the "immediate post-operative" result.

The cases constituting this series have not been examined at a sufficiently long interval after operation to give an opinion on the remote post-operative results. There are, however, certain factors bearing on the ultimate result which deserve serious consideration. I have always considered that the greatest and most far reaching difference between any intra-capsular method and the capsulotomy method (other things being equal) is that the vitreous body is deprived of the support of the suspensory ligament and capsule, a partition which not only serves to retain the vitreous in position and allows the posterior chamber to form, but which prevents to a large extent invasion of the vitreous by cell elements which give rise to vitreous opacities. The remote changes to which the vitreous is liable as the result of this deprivation is the test by which the intra-capsular method must eventually stand or fall in those cases in which it is admittedly the operation of choice from a purely technical point of view. There are many unpleasant possibilities to look forward to when the eye is in this condition. Firstly, the mechanical effects of the undamaged vitreous body pushing forward against the iris must be considered; and if the hyaloid membrane is damaged, as it frequently is, there are additional disadvantages associated with the approximation of the vitreous to the region of the section (in a combined operation), and the localized hernia into the anterior chamber (in a "Simple"). Secondly, we must bear in mind the possible effects on aqueous secretion and circulation of not only the altered position of the vitreous body, but also of the damage to the ciliary epithelium from dragging on the suspensory fibres when the lens is torn free. The effects of traumatizing the ciliary body in this way as regards those

cellular elements from which the suspensory fibres are derived (about whose activities we know very little), and also the possibility of stirring up definite precursors of fibro-plastic activity, has not been sufficiently considered from the point of view of late results. A study of coronal sections through the ciliary region on the one hand, and a series of specimens of gross staphylomata of the cornea with the suspensory capsule barrier in position and healthy posterior segments on the other, has given me the impression that as long as the suspensory capsule barrier is intact the posterior segment may remain healthy under the most adverse circumstances, but that damage to the suspensory ligament and ciliary body is very liable to be followed by pathological conditions of the posterior segment. The great drawback about the formation of opacities in the vitreous and interference with vision thereby as compared with the formation of capsular opacities (after-cataract), is, that after-cataract is compatible with a healthy posterior segment, and may, with care, be relieved, whereas vitreous opacities of an organized type tend to be progressive and incurable. It may be contended that a needling for after-cataract inflicts just as much trauma on the ciliary body as the dragging out of a lens in its capsule, and that after needling the vitreous is herniated into the anterior chamber. For this reason I deliberately use the words "with care." Needling of a capsule as frequently performed is certainly open to such an objection. I will not go into detail as to how needling is effected in this clinic; it is done with a Bowman's needle with the utmost care, without dragging but rather with a series of consecutive stabs or lifts with the extreme point of the needle. The smallest aperture is effected which will give good vision; for preference the lenticular or broadly ovoid aperture is placed obliquely down and in.

From time to time I have examined a number of cases in which an apparently perfect intra-capsular operation has been performed and I have rarely seen one free from vitreous opacities. I have no doubt that in Madras we deal with a type of case which is very much more liable to reaction than is met with, for instance, in Europe or America, and for this reason one cannot form a true opinion as to the ultimate results of leaving the vitreous unsupported by the suspensory capsule diaphragm. I am aware that numbers of experienced observers report excellent visual results after removing the lens in its capsule, and not only good results shortly after operation but for periods of years. Still, in spite of this, I am almost persuaded that in so far as our cases are concerned, where no selection is made and constitutional disease does not constitute a contra-indication to operation, it frequently happens that the vitreous left exposed with only the very delicate (and sometimes torn or non-existent) hyaloid to

protect it, is invaded by cellular elements thrown into activity by the trauma of operation. In investigating this question I formerly made a considerable number of examinations with the Gullstrand slit-lamp and corneal microscope after the method of Professor Vogt and observed that even in perfect "operative" and "immediate post-operative" results with Barraquer's technique (or any other intra-capsular technique) examination at the time of discharge (14 to 21 days after operation) almost invariably revealed masses of pigment not only on the surface of the vitreous but extending back into the substance of the vitreous and also various types of vitreous opacities. It was impossible to say whether these masses of pigment represented collections of migrating melanoblasts or merely tiny deposits of free pigment, but in certain cases it appeared that cells were undoubtedly migrating and giving rise to delicate fibrillar net-works which radiated backwards through the vitreous body.

Since then I have had the advantage of attending Professor Vogt's course on slit-lamp microscopy, and now realize that many of the vitreous opacities which I formerly observed were not of such serious import as I had imagined. In fact it is quite compatible with a healthy vitreous to see several types of structural opacifications with the microscope. It is also quite a common occurrence to see masses of pigment disseminated throughout the anterior and posterior chambers, on the surface of the hyaloid, and in the prolapsed vitreous after an intra-capsular operation, the significance of which may not be of great importance. This being so I have to a certain extent modified my ideas, expressed before now in the annual reports of this hospital, as to the prognostic importance of post-operative vitreous opacities. There is, however, in any operation where the globe is opened, blood-vessels and connective tissue damaged, and the vitreous exposed, the possibility of fibroblastic invasion. The manner in which the vitreous is affected by traumatism unassociated with bacterial invasion is most important. My general impression from the observation of numbers of specimens is that the vitreous, once invaded by cellular elements, is liable to eventual opacities of a serious progressive nature, and that opacities of this type once formed are unalterable. It is not contended that there is no such thing as amorphous vitreous opacities capable of undergoing absorption either spontaneously or in association with some form of treatment, but the possibilities referred to here do not come under this head. The type of vitreous change which is referred to is that associated with trauma and with the possibility of cells being set free which invade this structure, such as rupture of a retinal vessel, or the penetration of the posterior segment by a foreign body which carries mesoblastic cellular elements in its

track, or the performance of a section on the anterior segment which removes the capsule and suspensory from the vitreous in front and allows the cellular elements of the traumatized tissues access to the vitreous itself. The hyaloid evidently is frequently ruptured even in the most favourable cases, although it is often possible to demonstrate the fossa patellaris by means of the irrigator after a favourable intra-capsular operation. After the section has healed rupture of the hyaloid is sometimes evidenced by the fact of a mushroom-like mass of jelly protruding through the pupillary aperture covered with gold-dust-like pigment spots and permeated by fine opaque fibrillar strands. At times one sees a formed posterior chamber with an apparently intact hyaloid covered with fine gold-dust-like pigment points.

It is difficult to understand why vitreous fibrils should become opaque when *unassociated* with fibroblastic activity. It is presumably a physical change making itself evident in an altered refractive state. That dense progressive fibrillar opacities do occur after the type of trauma referred to above in which fibroblastic activity cannot be demonstrated, is a familiar fact. It seems reasonable enough to suppose that the main mass of the vitreous is merely extra-cellular material derived from cell bodies for the most part situated in the region of the ciliary body and ora serrata, and that actual vitreous itself does not contain cells, but is a derivative of cells so situated, which throw out long processes of a very delicate nature which hold a semi-fluid matrix in their interstices. These, in different positions, give rise to different appearances, such as the fibrils which run forward to become continuous with or from the suspensory ligament itself, and those which, welded together, dip behind the lens to form the delicate homogeneous hyaloid and line the patellar fossa. It must not be forgotten that in traumatizing the suspensory ligament we are traumatizing that region from which the solid elements of the vitreous itself spring, which is for all practical purposes identical in origin with the enveloping membrane and radiating transparent solid fibrillar portions of the vitreous mass. It is unnecessary further to draw the attention of those who are interested in this matter to the great importance of treating the vitreous with respect in all operative procedures on the eye. In this clinic we regard an eye as potentially lost in which a vitreous escape of any kind has occurred or in which vitreous comes to lie against the back of the section; or even when there is a hammock-shaped drawn-up pupil with pillars rolled backwards and the vitreous occupying a plane anterior to the iris in the upper third of the anterior chamber. Those who appear to regard vitreous traumata of various kinds as a mere incident, undesirable in nature, but of no great importance as regards eventual prognosis, should follow up and

carefully study the changes which take place in the vitreous as the result of the development of fibrillar streamers from the region of an operative trauma. In cataract work the eventual test of such vitreous changes is of course the vision, and it must be confessed that many cases in which there is considerable vitreous change on microscopic and ophthalmoscopic investigation, preserve fairly good vision for a considerable time. Strictly speaking, the result of an operation for cataract ought to be recorded at least twelve months after the section. In this way only will the truth be arrived at as to the permanent and lasting value of any method. This is a very difficult matter in India, but no difficulty ought to be experienced in gradually collecting large figures in other countries where hospital cases are more easily kept in view. If only the perfect "operative" and "immediate post-operative" results were followed up the figures would be strictly comparable. In making these statements I do not lose sight of the fact that it is better for a patient to have vitreous opacities and a gradually darkening eye than not to have vision at all. The danger of the development of vitreous opacities after removing the lens in its capsule may not be so important as would appear from the foregoing when applied to selected eyes, healthy except for cataract, such as are usually chosen for operation in Western clinics, but even then one has to consider the other effects of leaving the vitreous unsupported, as suggested at the beginning of this note. Time and the accurate records of carefully followed cases will tell.

A NOTE ON PULFRICH'S PHENOMENON WITH A SUGGESTION ON ITS POSSIBLE CLINICAL IMPORTANCE

BY

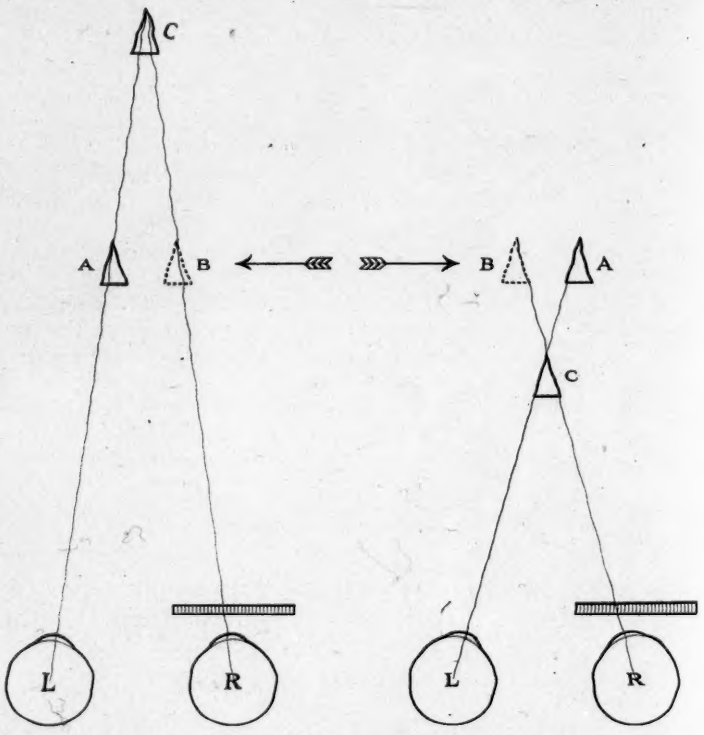
H. GRIMSDALE

LONDON

ABOUT eighteen months ago, Mr. J. H. Tomlinson drew my attention to the curious phenomenon which Pulfrich had recently described, and gave me a small model on which the phenomenon could be demonstrated.

It will be remembered that Pulfrich had noted the fact that if one eye has its light sense diminished by covering with a dark glass, the image from this eye is recognized by the brain more slowly than the image from the normal eye.

This is demonstrated by means of two pointers which move in a plane; when observed by two eyes whose light sense is equal, it is seen that the two pointers are in one plane, but when the light sense of one is diminished, the moving pointer appears to revolve round the other. The explanation is that the recognition of a



stimulus varies in time, with the intensity; a lesser stimulus requires a longer time. Therefore, though the eye which is covered with a dark glass sees an object moving at the same rate as the unaffected eye, the movement appears to begin rather later, and the object is "seen" behind its true position, that is to say the brain receives the impression from the object at a given point but takes longer to interpret it.

Two diagrams will make the apparent movement clear. The direction of movement is shown by the arrow.

In the diagrams R is the right eye behind the dark glass, L the left eye; A the object as seen by the left (normal) eye, B its image as seen from the right eye. C is the image in the faulty position.

I do not think that it has been pointed out that this phenomenon has a definite limited clinical importance; we are, as ophthalmic surgeons, not infrequently consulted by patients who find difficulty in games; men, getting on in years, who have been expert in games with a moving ball, find themselves unable to judge its position with their former accuracy, and, therefore, do not meet the ball with the middle of the bat. Pulfrich's phenomenon seems to give a probable explanation; at least in a considerable proportion of cases.

Not only will the normal loss of transparency of the lens diminish the acuity of the light sense and therefore lengthen the time reaction, but also, if one eye has any change specially diminishing its acuity, there will be an alteration of the position of the ball varying with the angle at which it approaches the striker.

I had suspected that this was the chief difficulty in a number of patients but had not found one which appeared to prove it, until recently; however, a few weeks ago I was consulted by a young man who had been a good tennis player, on account of this difficulty; that the balls seemed sometimes too near and sometimes too far; on going into his history, I found that he had had some three months before, an attack of retro-ocular neuritis. From this he had recovered well; his acuity was 6/9 all, in the affected eye; but when I tested him, the light sense was manifestly lessened, and with Pulfrich's model, the points seemed constantly to revolve round one another.

I found on further examination, that a No. 2 smoke, placed in front of the good eye stopped this apparent movement; and I, therefore, suggested to him that it might be possible to correct some of the disability by wearing a dark glass over the good eye.

He promised to let me know how this arrangement worked; but so far I have not heard.

It is clear that the image perception being delayed in both eyes there will be a constant mal-appreciation of the true position; but a constant error is much more easily corrected mentally than one which is always varying.

It seems to me probable that the loss of transparency which constantly comes on, in the lens, with advance of years, is the cause, through this delayed recognition, of much of the loss of accurate timing in games with a moving ball.

NOTE ON THE ILLUMINATION REQUIRED FOR THE INSTANTANEOUS COLOUR PHOTOGRAPHY OF THE EYE (LIFE-SIZE)

BY

BERNARD CHAVASSE

LIVERPOOL

FOR instantaneous colour photography a single plate process, Autochrome, Paget, Agfa, etc., is necessary. Such plates are necessarily slow. Thus for an open landscape in midday summer sunshine an exposure of one second may be necessary with an aperture *f*8. Further, owing to the coarseness of the colour graining the nearer life-size the better, especially if the picture is to be used for optical projection.

In order to guard against movement of the eye or of its lids the exposure should not exceed one-twentieth part of a second, which is just less than the lid closure reflex time. (Exner). The exposure factor is therefore $\times 20$. A correction must be applied for the nature of the subject—a coloured object copied life-size. This may be taken as $\times 4$ (Watkins). Moreover, in order to secure adequate depth of focus a long focus lens must be used stopped down to at least *f*20. This necessitates the further factor of $\times 8$.

It is necessary, therefore, that the illumination of the object be $1 \times 20 \times 4 \times 8 = 640$ times that provided by the midday summer sun.

Now the light of the sun at the zenith is equivalent to 60,000 candles at a distance of one yard (Poor) which is four candles per square inch of illuminated surface, so that it may be said that for the instantaneous colour photography of the eye an illumination of $640 \times 4 = 2{,}560$ *candles per square inch is required.*

Can this degree of illumination be obtained? An explosive flash of magnesium powder, even when mixed with salts of cerium instead of the more familiar chlorate of potash, just fails to give enough light, even when burned six inches or less from the eye with a glass screen intervening. Nor have I been successful in using it in conjunction with a large condenser, partly perhaps because the light emitted from a sheet of flame does not lend itself well to condensation, and partly perhaps on account of the colour of the glass of the condenser, which cuts off many of the more actinic rays.

The alternative is the electric arc assisted by some optical projection system for the concentration of its rays, and in this connection it may be noticed that on February 15, 1924, at the National Physical Laboratory an "Artisol" lantern (which is a

lantern provided with a mirror reflecting a solid angle of rays the plane angle of which is 135 degrees, and provided with a thin single condenser) effected, when using only 25 amperes, a screen illumination (38 square feet) of 65 candles per square foot, *i.e.*, 2,470 candles. All this light had to pass through a lantern "gate" of about two-thirds of a square inch in area (24 mm. by 18 mm.) in which therefore the illumination was 3,705 *candles per square inch*. Since the temperature in the gate is about 700° Centigrade it would of course be necessary to place the instantaneous shutter in connection with the illuminating source instead of in connection with the photographic apparatus.

Actually, the area to be photographed is greater than that of a circle whose diameter is equal to the diagonal of the gate. But owing to inherent optical defects the sufficiently illuminated area is considerably larger when no hole, slit, or gate is used.

The further step to the colour photography of the fundus oculi would seem to be not an insuperable one, if, as in the Artisol apparatus, condensers are largely or entirely replaced by a converging mirror (by which the chromatic and spherical errors inherent in condensers can be eliminated once and for all), and combined with a hole lamp system (obviously superior to the magnesium flash and condenser system by means of which black and white photographs of the fundus have long been familiar). Such an apparatus is also clearly superior to a hole lamp system with the sun as source, involving a cumbersome apparatus including a siderostat or its equivalent.

Taking the intrinsic brilliancy of the sun when directly overhead as observed through the terrestial atmosphere as 80,000 candles to the square inch it is significant to note that a Pointolite enclosed arc at its maximum intensity (the tungsten bead being then molten) has an intrinsic brilliancy of 60,000 candles to the square inch, and has the advantage over the sun of being not only stationary but also constant. It would seem probable that it will be with a lamp of this type that colour photography of the fundus will be achieved, and it is likely that it will be used in conjunction with a mirror condenser and a hole.

AN OPTICAL ILLUSION

BY

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QUETTA

THE phenomenon to which this paper refers, requires some closeness of observation to appreciate, and so far as I am aware, has not yet been published.

It was first noticed about eight years ago and has been experienced repeatedly since then, and corroborated by others.

When the observer is walking, preferably at about the pace of a slow stroll, across a series of dark lines such as the intervals between the boards of a landing stage, or the intersections of concrete footpath, with the eyes directed forwards and at rest; then those lines between the point to which the eyes are directed and the feet appear to vibrate, to flicker, or alternately to appear and to vanish. It is best seen perhaps if the eyes are allowed to be directed to the ground about 50 yards a-head, without looking *at* anything in particular. Then the lines travelling towards the feet will be seen to flicker, this flickering apparently increasing to a maximum a short distance in front of the observer's feet and then disappearing.

Further, it is only possible to say that there is a definite optimum rate of progression at which the observation becomes possible and secondly, that the lines will not vibrate if the observer looks *at* them.

At first I was tempted to suggest that this observation might depend upon a concentric arrangement in rings in the retina of the visual units, in travelling over which the images of the lines would pass across rings of relatively insensitive material and consequently would appear to flicker. But I am indebted to Dr. H. Hartridge for what appears to be the real solution. He says: "The eye when performing 'fixation' actually performs a very fine rapid nystagmus. The images of lines moving slowly over the periphery of the retina will, therefore, move in jerks. If the lines move at the right speed the images will first stand nearly still on the retina and will then jerk to a new place where they will once more stand still approximately. Thus the apparent optimum rate of progression 'a slow stroll.' Thus the absence of the effect if you look *at* them."

If this is so, then by shutting one eye, all the lines should vibrate simultaneously, but I am so circumstanced at present as to be unable to carry out this corroboration.

THE COUNCIL OF BRITISH OPHTHALMOLOGISTS, ITS CONSTITUTION, AIMS AND WORK

The following brief account of the formation and activities of the Council is published to make more widely known its constitution, the purposes for which it was founded, and the work it has accomplished.

THE Council of British Ophthalmologists was founded at a meeting held at the House of the Royal Society of Medicine on May 2, 1918. It owed its inception to the need for some body which could act authoritatively in regard to any questions of ophthalmological interest arising in connection with national industries or public services. Formerly such questions were referred, either to scientific societies, which were not constituted to deal with them, or to individual ophthalmic surgeons, who could express only their own opinions. Fortunately, many of those surgeons to whom application was made were well fitted to give advice, but some at least felt that advice would be of more value if given after the subject had been considered by a council representative of the general body of British ophthalmologists.

The following are the rules of the Council:

1. Name. The Council shall be called "The Council of British Ophthalmologists."

2. The functions of the Council shall be to take cognizance of and act in all matters of ophthalmic interest arising in connection with national industries and public services, and to initiate or advise concerning movements which have for their objects the welfare of the eyesight of the community.

3. The Council shall consist of (*a*) the Presidents and Past Presidents of the Ophthalmological Society of the United Kingdom and of the Section of Ophthalmology of the Royal Society of Medicine and the Master of the Oxford Ophthalmological Congress; (*b*) ten members elected annually, four by the Council of the Ophthalmological Society, four by the Council of the Section of Ophthalmology of the Royal Society of Medicine, and two by the Council of the Oxford Ophthalmological Congress. The elected members shall commence their duties on July 1 in each year.

The Council shall have power to co-opt any individual to act with it for any special purpose and may delegate similar powers to any committee.

4. The Officers shall consist of a President, two Vice-Presidents, a Secretary, and a Treasurer, to be elected annually.

5. The Council shall meet at least once in every quarter. Five shall form a quorum.

6. An Executive Committee shall be appointed consisting of the President and Secretary, *ex officiis*, and four other members of the Council elected annually. It may be called together by any one of its members to consider urgent business. Three shall form a quorum.

7. The expenses of the Council shall be met by a guarantee fund and by voluntary contributions. The amount called up in any one year shall be proportioned to the amount guaranteed.

A meeting open to all British Ophthalmologists is held once a year, usually at the time of the annual congress of the Ophthalmological Society of the United Kingdom. The annual report of the Council is presented to this meeting and is subsequently published in the BRITISH JOURNAL OF OPHTHALMOLOGY.

The Council has appointed numerous committees to investigate and report upon questions engaging its attention. The power of co-option authorized by Rule 3 has frequently been exercised. Ophthalmologists who are not members of the Council, and representatives of other branches of science, *e.g.*, physiologists, physicists and illuminating engineers, have served on committees when their special knowledge has been thought necessary for the elucidation of the subjects under consideration. Co-opted members are invited to attend the meetings of the Council at which the reports of the committees on which they serve are considered.

All reports passed by the Council for publication appear in the BRITISH JOURNAL OF OPHTHALMOLOGY, and those of more general interest have also been published in other medical periodicals and in the lay press.

The following is a list of the published reports:

*On Standard Illumination of Snellen's Distant Test Types (*Brit. Jl. of Ophthal.*, Vol. III, p. 22, 1919).

*On the Teaching and Examination of Medical Students in Ophthalmology (*Brit. Jl. of Ophthal.*, Vol. III, p. 165, 1919).

*On the Desirability of a Special Qualification in Ophthalmology (*Brit. Jl. of Ophthal.*, Vol. III, p. 558, 1919).

On the Visual Requirements of Persons Licensed to Drive Mechanically-Propelled Vehicles on Public Roads (*Brit. Jl. of Ophthal.*, Vol. IV, p. 28, 1920).

*On the Standardization of the Notation of the Axes of Cylinders (*Brit. Jl. of Ophthal.*, Vol. V, p. 317, 1921).

*On the Institutional Treatment of London County Council School Children Suffering from Contagious Eye Diseases (*Brit. Jl. of Ophthal.*, Vol. V, p. 280, 1921).

*Copies of these reports may be purchased from the Hon Secretary, W. H. McMullen, 86, Brook Street, Grosvenor Square, London, W.1

*On some Public Authorities who are in the Habit of Referring Ophthalmic Cases to Hospitals for Examination and Treatment and (or) Report (*Brit. Jl. of Ophthal.*, Vol. V, p. 467, 1921).

*On Sight-Testing by Opticians (*Brit. Jl. of Ophthal.*, Vol. VI, p. 554, 1922).

*On Standards of Vision for Candidates for Scholarships and Teacherships under Local Education Authorities (*Brit. Jl. of Ophthal.*, Vol. VIII, p. 167, 1924).

*On the Institutional Treatment of Keratitis (*Brit. Jl. of Ophthal.*, Vol. VIII, p. 233, 1924).

On the Administration of Optical Benefit by Approved Societies (*Brit. Jl. of Ophthal.*, Vol. VIII, p. 61, 1924).

The Council has sent its reports to the various public authorities concerned, and has communicated with them by letters, by personal interviews with representatives, and by deputations.

The advice of the Council has been sought by various public bodies, and representatives were nominated to serve on a joint committee of the London County Council, and the Illuminating Engineering Society on Eye-Strain in Cinemas (Report in *Brit. Jl. of Ophthal.*, Vol. IV, p. 482, 1920), and on a joint committee of the Illuminating Engineering Society and other bodies on Glare from Motor Car Headlights.

Representations have been made repeatedly to the General Medical Council urging that ophthalmology should be made an obligatory subject in all qualifying examinations, but hitherto without success. That Council has, however, recommended: "That every student should be required to attend a course of practical instruction in ophthalmology of not less than ten weeks' duration, and that no student should be admitted to the final examination unless he presents a certificate to the effect that he has attended such a course regularly and that his work in connection therewith has reached a satisfactory standard."

The report on the visual requirements of motor drivers was communicated to the police authorities in London and elsewhere. Some improvement in the standards required has followed.

As the result of a deputation of the Council to the Ministry of Health, institutional treatment for contagious eye diseases has been made available for London County Council school children; and in accordance with the recommendations in the report on institutional treatment of keratitis the Ministry has issued an instrument enabling the Metropolitan Asylums Board to undertake treatment of children suffering from interstitial keratitis.

The standards of vision recommended for candidates for scholarships and teacherships under Local Education Authorities have been adopted by the Board of Education, and the Council's

*Copies of these reports may be purchased from the Hon. Secretary, W. H. McMullen, 86, Brook Street, Grosvenor Square, London, W.1.

report on the subject was published in the official journal of the department.

The question of the provision of optical or ophthalmic benefit for insured persons under the National Health Insurance Acts has received the close attention of the Council. An interim report on the subject was published in February, 1924 (*Brit. Jl. of Ophthal.*, Vol. VII, p. 61). In April, 1924, a deputation proceeded to the Ministry of Health to discuss the subject. In May, 1924, a meeting of the Council and representatives of the British Medical Association was held, when it was agreed that a joint committee of the two bodies should be formed in order to co-ordinate their actions in regard to this subject. This committee drew up a series of recommendations, which were approved by the Council, forwarded to the Ministry of Health, and published in the BRITISH JOURNAL OF OPHTHALMOLOGY (Vol. VIII, p. 590, 1924).

At the present time committees are dealing with the following subjects: (1) Standardization of test-types; (2) the methods adopted in various parts of the British Isles for the education of children suffering from defective eye-sight due to myopia and other causes; (3) the extent to which effect has been given to the recommendation of the Departmental Committee on the Causes and Prevention of Blindness in respect of industrial eye diseases and accidents.

The endeavour to protect the public from injury by untrained and incompetent persons professing themselves capable of treating defects of the eyes calls for the constant vigilance of the Council.

The above epitome of the Council's activities will suffice to show that it has justified its existence and effectively served the purposes for which it was founded. It appears probable that with increasing recognition by various public bodies its usefulness will steadily become greater.

OPHTHALMIC BENEFITS FOR MEMBERS OF APPROVED SOCIETIES

Our readers will be interested to know the state of affairs with regard to the administration of ophthalmic benefits for members of approved societies. We, therefore, quote in full the admirable résumé published in the *Lancet* for January 3 of this year:

"One of the subjects before the Royal Commission on National Health Insurance now sitting is the best way to dispose of the surpluses which some of the approved societies possess and which are available for the granting of certain additional benefits to their members. There are 18 of these 'additional benefits,' and according to an official statement prepared for the use of the Commission and already published as a Blue-book* the most

popular of the additional benefits, next to dental treatment, is the so-called 'optical benefit.' For the year 1924 nearly £40,000 is available for it. In one very large society, already, the claims have numbered 500 a week. A 'model schedule' provides that 'payment in respect of the cost of an optical appliance shall only be made on the production of a prescription from a qualified practitioner or a hospital.' In some instances, says the statement, and in particular in rural districts, it has been found that to insist on this condition is impracticable and its strict enforcement has been relaxed. If we may believe a writer in the *Optician,* as a matter of fact, all the largest approved societies (and many of the smaller ones) send their members to an optician, and not to a qualified practitioner or a hospital. Whether or not this statement of the case requires qualification, there is, at any rate, sufficient truth in it to demand the attention of those medical bodies whose duty it is to have regard both to the professional interests of their members and to the preservation of the nation's eyesight. Three such bodies exist and are at present jointly concerned in considering the various problems under review with the object of ensuring that the model schedule of the Ministry of Health, just quoted, which at present, unfortunately, is in danger of becoming a dead-letter, may become really effective. The first of these three bodies is the Council of British Ophthalmologists, formed in 1918, representative of the Ophthalmological Society and the Ophthalmological Section of the Royal Society of Medicine†; the second is the Ophthalmic Committee of the British Medical Association, and the third is the 'Ophthalmic Benefit Committee,' which has been formed during the past year, membership of which is open to those who hold or have held posts as surgeons, assistant surgeons, clinical, or refraction assistants at the ophthalmic hospitals or general hospitals with ophthalmic departments, and are in regular ophthalmic practice. The chairman of this Committee is Mr. H. L. Eason, senior ophthalmic surgeon to Guy's Hospital. It is understood that the aims of these three bodies with regard to the matter at issue are in perfect harmony.

Last spring a joint committee was formed by the first two bodies, which drafted a scheme for ophthalmic benefit, and this committee has now agreed to allow equal representation to the Ophthalmic Benefit Committee in any approach to the Ministry of Health and in considering the various problems under review. It is

* Appendix to Minutes of Evidence, Part I. Statements prepared by certain Government Departments. H.M. Stationery Office. 8s. 6d.

† As our readers are aware the Council of British Ophthalmologists is even more representative of British Ophthalmology than here indicated. [EDITOR—*Brit. Jl. of Ophthal.*]

proposed that a list of ophthalmic medical practitioners qualified and willing to see insured members of approved societies should be prepared in accordance with the following principles. Anyone desiring to join in the scheme will have to furnish evidence (*a*) that he has held hospital or other appointments affording special opportunities for acquiring special skill and experience of the kind required for the performance of the service rendered, and has had actual recent practice in performing the service rendered or services of a similar character; or (*b*) that he has had special academic or post-graduate study of a subject which comprises the service rendered, and has had actual recent practice as aforesaid; or (*c*) that he is generally recognized by other practitioners in the area as having special proficiency and experience in a subject which comprises the service rendered."

ANNOTATIONS

Cranial Artefacts

In an article (*Rev. gén. d'Ophtal.*, March, 1924), dealing with a case of oxycephaly, Cosmettatos, of Athens, makes a remarkable statement of a custom in Greece which is probably unknown to the majority of readers of this journal. The paragraph is the following: "The history and the typical symptomatology of our patient exclude the hypothesis that the abnormal form of the skull is to be attributed to an artificially brought about deformity. This custom is fairly wide-spread in Greece and especially in Epirus, the custom, namely, of exerting pressure upon the occiput of new-born children so as to produce flattening of the occipital region of the skull." *De gustibus non est disputandum.* The Chinese, in the past, were accustomed to squeeze the feet of their infants; the modern Greek apparently squeezes the other end of the baby. The Armenians are in the habit of putting a dry cloth round the infant's head and afterwards damping it in order to produce the typical sloping forehead which is characteristic of so many of this race. The shape of the skulls depicted on ancient Hittite monuments shows similar characteristics, and may have been produced in the same way, since the Armenians are usually regarded as descended from this race.

Refraction in General Practice

In the *British Medical Journal* for December 6, 1924, is an article by Dr. MacRae, of Corbridge-on-Tyne, on this subject; and a very good article it is.

As soon as anyone is qualified there is nothing to stop him or her from setting up as an oculist. There is no reason why any who

are engaged in general practice should not do their own refractions. It is largely a matter of time, practice and decent visual acuity on the part of the examiner. We have known of several instances where men, on going into general practice, began to do their own refraction work; but few keep it up. The majority find that they have not the time for it, nor do they obtain sufficient practice to ensure their being certain of their results. A few get sufficient practice and some of these eventually give up their general work and become ophthalmic surgeons. Then comes the rub. Their patients naturally suppose that one who calls himself an ophthalmic surgeon in the Telephone Book or Court Guide is competent in all branches of his work, and is fit to perform operations. Few of us are born operators, some of us become from constant practice tolerably sound operators; others never pass the duffer stage. To become expert the operator must start young, and we do not consider that ten years or more spent in general practice is the best form of introduction for such delicate work.

All will admit the advantage of a sound knowledge of general medicine for the ophthalmic surgeon. Some of us seem unable to see an inch beyond our spheres and cylinders, and it is pathetic to see surgeons ordering an optical correction which borders on plane glass to anaemic young women who only need a little fresh air and regulation of the action of their bowels to cure their headaches. In our opinion a short course in general practice forms an excellent introduction to the study of ophthalmology, but no amount of general knowledge will dispense with the absolute necessity for those who aspire to become ophthalmic surgeons of going through the ophthalmic mill and being properly trained in diseases of the eye.

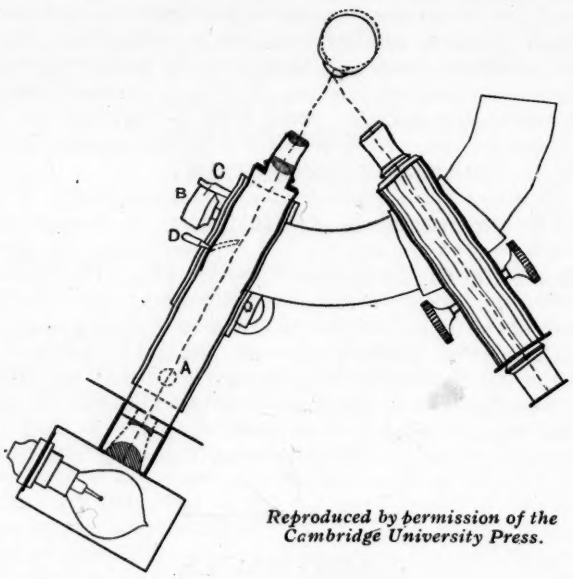
ABSTRACTS

I.—SLIT-LAMP MICROSCOPY

(1) **Fincham, E. F.—A new form of corneal microscope with combined slit-lamp illuminating device.** *Trans. Optical Soc., Vol. XXV, No. 3, 1923-1924.*

(1) The following is **Fincham's** description of this new instrument. Hitherto, the illuminating system and the observing microscope have been free to move independently; this necessitated the re-adjustment of both direction and focus when the inspection was moved from one part of the eye to another. In the present instrument, both the illuminating system and the microscope are

mounted upon an arc which has its centre at the focus of the illuminating beam (see figure). Thus the only adjustment that is required with this instrument is the focusing of the projected image upon the part of the eye to be examined, when the image of the latter will automatically be brought into the centre of the field of the microscope. This adjustment is made by racking forward the arc carrying the two components of the instrument—exact focus being secured when the image appears centrally in the microscope field. The decentring effect produced on the microscope image when the



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instrument is out of focus is shown in the figure. The cornea of the eye, as shown with a broken line, is placed beyond the focus of the illuminating beam and is consequently out of centre with the microscope. In order to examine the section under different angles, it is only necessary to swing the microscope along the arc, the centring and focusing remaining unchanged. This movement is necessary as, although where possible it is often desirable to examine the section perpendicularly to the illuminating beam, a smaller angle of observation must be employed when observing the deeper structures, owing to the oblique view being cut off by the iris.

Although, for the purpose of studying the sections of the optical media, the combined centring of the microscope and illuminating system is the ideal arrangement, it is found in practice that many

pathological states of the eye are seen to greater advantage by indirect illumination.

The illuminant in this model is a 12 volt., 24 watt, projection-type lamp having a small straight filament which is particularly suitable for illuminating the slit aperture used. Between this and the slit a condensing system of short focal length, consisting of a deep hemispherical positive followed by a strong negative lens, is placed so as to produce a practically parallel beam just large enough to cover the length of the slit. This device was introduced in order that a maximum amount of the light passing the slit should enter the projection lens, which is of comparatively small aperture.

The projected image is produced by a 2-inch microscope objective placed at a distance of 160 mm. from the slit. This is found to give a well-defined image free from aberration effects. In the plate carrying the slit is also a small circular aperture which may be substituted for the slit when it is desired to examine surfaces, either of the optical media or of the iris, conjunctiva, etc. By suitable adjustment of the directions of illumination and observation, the microscope for ordinary use gives a magnification of about 20 diameters, and although this, of course, may be increased it is not generally useful to employ more than double this magnification. To allow of the adjustments for indirect illumination, the illuminating system has been mounted upon a plate which is capable of rotation in a horizontal direction about a bearing *A* by means of a screw *B*. In order that the original position of correct centring relative to the microscope may be returned to without difficulty, the head of the driving screw is marked with an index line to read against a zero mark on the pointer *C*. In addition to this, the projection lens has been mounted in a sliding tube operated by a handle *D*, to enable the focused image of the slit to be projected, to a point behind that under observation in the microscope, if desired.

In this way the possibility of indirect illumination has been gained without sacrificing the principle of the combined adjustment of illuminating system and microscope, and especially that of making measurements of intraocular distances, which is of great advantage.

An important use of the corneal microscope is the determination of the apparent depth of the anterior chamber of the eye. This is made with the existing forms of corneal microscopes by determining the adjustment necessary in order to focus successively the cornea and the anterior surface of the crystalline lens. This method is, however, open to error as it depends upon the observer's estimation of exact focus and also upon the control of his own accommodation. These difficulties are avoided in making the measurement with the new instrument. Owing to the fact that the microscope is directed constantly to the focus of the illuminating beam, the observed surfaces will appear central in the microscope field only when the

light is accurately focused upon it. It is therefore only necessary to measure the amount of movement required to bring successively the posterior surface of the cornea and the anterior surface of the lens into coincidence with a central cross-wire in the field of the microscope, to obtain the apparent distance between these two surfaces. To enable these readings to be taken, a small scale and vernier have been fitted to the focusing slide of the instrument.

We have seen this instrument, and besides the novel features which have been mentioned in the description by the author it is capable of use in the same ways as the usual model of the slit-lamp. It has, of course, only one tube in the microscope, so that binocular examination is not possible and also the microscope is not erecting. This makes the instrument to those who are used to a binocular instrument, which is also erecting, a little difficult in use. Other points are that illumination is only possible from the left hand side, and also that the angle between lamp and microscope cannot be reduced lower than 25 degrees. This, however, is not much more than the smallest angle possible with the slit-lamp in common use. The author states that he can easily alter the model so as to reduce this angle to 20 degrees.

The instrument is very compact and can be used upon an ordinary perimeter table, although a head-rest is necessary, and we saw at the Northampton Polytechnic (where Mr. Fincham has carried out his work) a very inexpensive model in some ways superior to the elaborate models now in use.

Mr. Fincham is to be congratulated upon his work, and the instrument as it stands is very useful. If he can make other modifications such as an improvement in the direction of illumination, it will be still more useful. The addition of a binocular microscope will, of course, greatly enhance its value.

It should be remarked that in its present form it fulfils all the requirements of clinical use, and it can be produced for about a quarter of the price of the instruments at present on the market.

CHARLES GOULDEN.

(2) **Koby, F. (Bâsle).—A study of shadows in microscopy of the living eye. (Les ombres portées en microscopie oculaire sur le vivant.)** *Arch. d'Ophtal.*, May, 1924.

(2) In this article, **Koby** points out how important it is to have clearly grasped the optical principles involved before an accurate interpretation can be applied to many of the phenomena seen with the corneal microscope and slit-lamp. The paper deals with the shadows carried back into the media behind an opaque object.

Opacity is the ratio between the intensity of illumination in the bundle of light striking an object, and that in the bundle which has

passed through it. So for a body of absolute transparency the opacity is unity.

The optical density of an object, which is a more valuable observation, is found by taking the logarithm of the opacity. Thus, if the incident and the transmitted bundle of light have the same value, the optical density is zero. And, if the transmitted bundle of light has a value of 1/10th of that of the illuminating bundle, the optical density would be unity.

The incident bundle of light may lose some of its intensity in three ways:

(1) By absorption—well seen in pigment of the anterior surface of the lens.

(2) By diffusion, especially where, as in a corneal opacity, the body is composed of minute points, each scattering the rays of light in every direction.

(3) By reflection from the surface, as in an epithelial bulla of the cornea or subcapsular vacuole in the lens.

The amount of this reflection depends on:

(*a*) The angle of incidence of the incident rays.

(*b*) The degree of polish of the surface.

(*c*) The difference in refractive index of the body under consideration, and the medium in which it lies.

As a rule several of the above conditions are taking place at the same time.

These shadows are most easily recognized when projected through a homogeneous medium on to a surface separating two media of differing refractive index, *i.e.*, through a relatively normal cornea on to its posterior surface. Where the medium is not homogeneous, as in marked general vascularization of the cornea, or in diffuse changes in the lens, the shadow is broken up and may not be recognizable.

Superficial new vessels in the cornea, small circumscribed opacities and epithelial bullae all show the clear cut shadow, and the contour of the object may be projected on to the posterior surface of the cornea, as on a screen, in which situation it has occasionally been erroneously localized.

Bullae on the cornea, and subcapsular vacuoles in the lens show reflexes from their anterior convex and posterior concave surface, as well as shadows carried back into the medium behind them.

The vitreous is not sufficiently homogeneous or optically dense to show the phenomena satisfactorily.

O. GAYER MORGAN.

II.—SYMPATHETIC NERVE AND TRIGEMINAL PARALYSIS

(1) **Adler, Francis, H., M.D., Landis, E. M., and Jackson, C. L. (Philadelphia). The tonic effect of the sympathetic on the ocular blood vessels.** *Arch. of Ophthal.*, May, 1924.

(1) **Adler, Landis** and **Jackson** set themselves to solve the following two questions:

(*a*) Is there a tonic influence of the sympathetic on the ocular blood vessels, whereby these blood vessels are normally kept in a semi-constricted condition?

(*b*) Is this tonic influence effective in preventing changes in the blood pressure from exerting their full effects on the eye where they might cause deleterious changes in intraocular pressure?

Previous investigations have been contradictory. Cats were used and anaesthetized with ether and then given urethane by a stomach tube. The intraocular pressure was measured by a fine Marey tambour connected to a hollow needle thrust obliquely through the cornea, the blood pressure by a mercury manometer connected with the opposite carotid or one of the subclavian arteries. The blood pressure was controlled by tightening or loosening a ligature placed round the aorta above the superior mesenteric artery. Various precautions were taken, and the following findings were recorded:

(1) Blood pressure and intraocular pressure came into equilibrium, in a minute after any change in the former.

(2) The average rise in intraocular pressure for a rise of 50 mm. Hg. in the blood pressure was 6.97 mm. Hg., while the same experiment performed after section of the sympathetic resulted in an additional rise of 1.7 mm. Hg. in the intraocular pressure. At higher blood pressures this effect was more marked.

(3) The height of the intraocular blood pressure at normal blood pressures is not affected by section of the sympathetic.

Clinical findings to the effect that intraocular pressure falls as a result of cutting the sympathetic are probably explained by the long continued miosis, and by the slight enophthalmos with atrophy of the orbital muscle giving altered readings with a tonometer.

The conclusions are therefore:

(1) The rise in intraocular pressure consequent upon a rise in blood pressure is kept in check by a local vaso-constriction of the ocular blood vessels through the cervical sympathetic.

(2) This action is increasingly protective as the blood pressure rises.

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F. A. WILLIAMSON-NOBLE.

(2) **Raeder, J. D. (Christiania).—"Paratrigeminal" paralysis of oculo-pupillary sympathetic.** *Brain*, Vol. XLVII, Part ii, 1924.

(2) **Raeder** first briefly describes the anatomical course of the sympathetic fibres to the face, and illustrates his description by an excellent diagram and drawing. He then gives notes of five cases in which the lesions could be localized to a limited space, the situation of which justifies the designation "paratrigeminal" paralysis of the sympathetic. The first case died from pulmonary tuberculosis while under observation. During life the case presented the following symptoms: vomiting, pains in head and neck which radiated beyond the trigeminal region, and epiphora of the left eye. Objectively there was a paresis of the left fifth nerve and paralysis of the left ocular sympathetic, without vaso-motor and trophic changes, and without evident enophthalmos. There was also diplopia, but it was not possible to identify the muscle at fault; it appeared as if there was a variable paresis of several muscles. The post-mortem examination revealed a tumour between the hypophysis and the Gasserian ganglion extending forwards to the superior orbital fissure, and backwards to the posterior limit of the middle fossa of the skull. It was of an indefinite endotheliomatous type. A diagram illustrates its position in relation to the neighbouring structures. The sympathetic fibres, the myelin sheaths of which were either absent or very thin, lay embedded in the tumour, and were infiltrated by its cells to such an extent that the fibres remaining could scarcely be distinguished. The clinical syndrome thus produced does not correspond to that ordinarily found in lesions of the cervical sympathetic, only the fibres destined for the eye being damaged. This is explained by the damage only taking place after the fibres to the rest of the face had been given off from the nerve. Of the other four cases, two were of traumatic origin, probably a fracture through the medial part of the middle fossa. In the first of these there was, in addition to an incomplete paralysis of the sympathetic, some affection of the trigeminal nerve, but the third, fourth and sixth nerves were intact. In the second case, in addition to a lesion of the second and fifth nerves, there was

a paralysis of the sympathetic which involved only the fibres to the dilatator. This would indicate that the lesion lay further forward, that is in front of the anastomosis between the carotid plexus and the oculo-motor nerve. Of the remaining two cases, in one, a paresis of the fourth and sixth nerves was associated with epiphora, neuralgic pains, and reduced tactile sensibility in the area of the first sensory branch of the trigeminal, as well as with ptosis and miosis. In the remaining case there was evidence of sympathetic paresis accompanied by trigeminal neuralgia. This case is said to resemble the affection of the sympathetic in herpes ophthalmicus described by Bing (*Gehirn u. Auge*, 1914). The site of the lesion could be verified only in the first case, but the author concludes that he is justified in assuming, from the similarity of the symptoms, that the lesion in the other cases must have been in the same situation. He says that he has found a considerable number of cases of trigeminal neuralgia accompanied by homolateral miosis recorded in the literature of the subject and considers that the majority of these were due to "paratrigeminal" lesions.

E.E.H.

(3) **Hartmann, E.—Section of the trigeminal nerve in man. (Les conséquences physiologiques et pathologiques de la section du trijumeau chez l'homme.)** *Ann. d'Ocul.*, Vol. CLXI, p. 242, 1924.

(3) **Hartmann** reviews the subject and gives some new evidence that division of the fifth cranial nerve proximal to the Gasserian ganglion results in:

(1) Loss of superficial sensibility.

(*a*) Epicritic, including light touch, slight modifications of temperature between 22 and 44 degrees centigrade, perception of two compass points;

(*b*) Protopathic, or sensation of pain and coarse changes of temperature; while deep sensibility, pressure sensation, bone sensation and muscle sense pass by the seventh cranial nerve.

Hartmann admits the possibility of the passage of sensory impulses by sympathetic fibres on blood-vessels in some cases.

(2) Vasodilatation of the area of the divided nerve and of the retina, a few days after the section. Hartmann explains this as due to irritation of the peripheral end of the divided nerve in scar tissue. He points out that such vasodilatation, after division of a sensory nerve, was shown by Bayliss in the case of division of a lumbar nerve and that it was explained as being due to bifurcation of the sensory nerve into a sensory branch and a vaso-dilator branch passing to the skin vessels of the corresponding area.

(3) Pupil changes. No inequality of pupil results from section, but during at least one hour after section of the nerve, there is an

increased reaction to mydriatics or to miotics, due probably to a loss of control. After seven days, there is miosis. This miosis is probably due to irritation of the distal end of the nerve by the scar tissue, so that an iris vaso-dilatation occurs in the same manner as explained above.

Hartmann summarizes his results as follow:

The fifth nerve contains no fibres

(1) of deep sensation,
(2) concerned in vaso-motor action,
(3) concerned with pupillary action,
(4) that have any effect on ocular tension.

Immediately after section of the fifth nerve, there is a state of hyper-excitability which is manifested by:

(1) increased vaso-motor reaction of the skin to stimulation,
(2) increased reaction of the pupils to drugs,
(3) increased sweating of the skin after pilocarpin injection.

HUMPHREY NEAME.

(4) **Hartmann, E.—Keratitis after section of the root of the fifth cranial nerve. (Les kératites après section de la racine du trijumeau chez l'homme.)** *Ann. d'Ocul.*, Vol. CLXI, p. 336 1924.

(4) According to **Hartmann** this arises (1) in cases with lagophthalmos (*a*) facial palsy preceding or following the operation; (*b*) from cicatricial contraction of the lids.

(2) In cases of slight trauma, as by wind-blown dust driven into the eye for a period—an eye in which corneal sensibility is absent.

(3) In cases of purely trophic origin, without any suggestion of lagophthalmos or trauma. Within a period of from two to ten days up to three months or more after the operation of nerve section exposure of the cornea for a few seconds may result in the formation of a finely granular appearance, due to partial desquamation of the epithelium.

Keratitis of trophic origin in section of the root is always relatively mild and curable by blepharorrhaphy if treated early.

Occurrence.—In 38 cases of nerve section, followed for at least three months after the operation, 20 (i.e. 53 per cent.) had keratitis.

Severity:—When compared with cases treated by excision of the Gasserian ganglion, those treated by section show a much milder form of keratitis.

Petrosal nerves.—In cases with damaged petrosal nerves, there is a higher percentage of keratitis incidence, but yet the integrity of these nerves does not in all cases prevent the development of keratitis.

Corneal sensibility.—Those with partial section of the fifth nerve with retention of corneal sensibility had a lower incidence of keratitis, but still the presence of this sensibility does not always prevent the development of keratitis.

Injury to the Gasserian ganglion is sufficient alone to account for keratitis, but, on the other hand, cases have occurred with undoubted damage to the ganglion without the appearance of keratitis.

Hartmann doubts the universal importance of the bearing of lacrymal secretion, and of corneal sensibility, and suggests that hypertony of the parasympathetic is at the root of the matter in most cases, as being accompanied, according to several workers, with a reduction in the resistance of the organism to poisons and so, possibly, to bacterial action.

He summarizes the factors which concern the development of keratitis after operation:

A. *Operative technique.*

(*a*) Division of the fibres in skin incision of the seventh nerve which supply the orbicularis muscle.

(*b*) Tearing of the nerve root instead of section.

(*c*) Injury to great superficial petrosal nerve.

(*d*) Injury to Gasserian ganglion.

B. *Sepsis of conjunctival sac,* and need before operation:

(*a*) To investigate the permeability of the lacrymal passages and to treat accordingly.

(*b*) To treat all conjunctivitis, even slight or chronic.

C. *Palpebral.*

(*a*) The necessity of blepharorrhaphy in case of facial paralysis.

(*b*) The need of autoplasty in case of cicatricial ectropion.

D. *Subsequent trauma to the cornea.*

The treatment of an established keratitis is the performance of an immediate blepharorrhaphy after careful cleaning. The lids should only be opened gradually during the course of several months.

HUMPHREY NEAME.

III.—MISCELLANEOUS

(1) **Blatt, Nicholas (Roumania).—Gumma of the ciliary body as a late syphilitic product.** (**Gumma des Ziliarkörpers als spätluetisches Produkt.**) *Klin. Monatsbl. f. Augenheilk.*, *Vol.* LXVII, 1921.

(1) **Blatt's** patient, aged 40 years, was infected 11 years previously. Inunction during one month. Four months later maculopapulous manifestations, otherwise healthy up to present. During

last four weeks the patient has experienced pain in the left eye and has observed that his sight with this eye is diminished in keenness. *Right eye*: Normal, V.R.=5/5. *Left eye*: Redness in the ciliary region, dulled flattened cornea, Descemet precipitates, adherent iris. In the upper corner of the anterior chamber a yellowish, markedly vascular swelling, apparently about 3 mm. in size, which pushes the iris before it. The sclera in this region protrudes in the form of a bean, has a dark blue colour and is extremely sensitive to pressure. High up behind the iris a greyish-yellow reflecting mass. By transillumination only a reddish-grey reflex. V.L. fingers at 0.5 m.—Wasserman +++ Painless enlarged glands. Treatment from 12.VII. to 26.VIII. Daily 3 gr. Ung. hydrarg ciner., 3.3 gr. neosalvarsan. After a four weeks' treatment there remains in the place of the swelling only a reddish-grey spot on the iris. At the time of discharge only slight punctiform cloudiness of the vitreous body. V.L.=5/15. Blatt refers to the published work of v. Hippel, Uhthoff, Busse, Swetsky, and Tooke on this subject, and lays particular stress on the late development of the gumma in his case (11 years after infection). At the same time he draws attention to Busse's statement that different apparently gummatous swellings should in reality be looked upon as papulous formations. In most of the known cases the gummatous formation developed between three months and one year after the primary infection. The therapeutic results were deplorable in the pre-salvarsan era, and the swelling disappeared only in quite exceptional instances in spite of anti-syphilitic treatment. Phthisis bulbi was frequently noticed.

V. ST. JOHN.

(2) **Witham, Lloyd, B. (Baltimore).—Teratoma of the lacrymal gland.** *Amer. Jl. of Ophthal.*, September, 1923.

(2) **Witham** reports a pathological rarity in the form of teratoma of the lacrymal gland. In 1918 he removed the tumour under local anaesthesia from a person aged 21 years. It had taken origin in the region of the accessory lacrymal gland, and presented into the opening of the palpebral fissure for about 7mm., interfering with the movements of the eyeball. The tumour was solid and measured 1.5 × 0.8 × 0.8 cms.; when the fibrous capsule was split with a knife there was exposed a small, well formed, sharp tooth, possessing a perfect coating of enamel. Microscopic section showed a loose connective tissue with muscle cells, islands of fat cells, and an area of normal bone, surrounded by a layer of flat cells. Five years after removal of the tumour there had been no recurrence.

J. N. TENNENT.

(3) **Fink, Karl.—Ocular lesions in pregnancy.** (**Augenstörungen im Gestationsprozess.**) (Univ-Frauenklin, Konigsberg.) *Abs. Zentralbl. f. d. gesam. Ophthal.*, May, 1924.

(3) In his paper **Fink** confines himself to disturbances of vision and to changes in the fundus oculi which occur in pregnancy, in cases of oedema of pregnancy, and in nephritis of pregnancy. His report and results are made from 108 cases, composed of eclamptics, pre-eclamptics, and pregnancy nephritics. He reports that 35 per cent. of these suffered from disturbances of vision. Fifty women were examined with the ophthalmoscope, and in fifteen patients there were changes in the fundus. In a later examination of forty-four cases eleven were still showing fundal changes.

Without going into special cases his conclusions are as follow:

1. An ophthalmoscopic examination should be made in all cases of disturbances of vision in pregnancy.

2. Loss of vision in pregnant women who suffer from nephritis, pre-eclampsia or eclampsia, is not serious in itself, and does not call for any interference.

3. In sudden loss of vision, partial or total in degree, the procuring of abortion is only necessary if there be a uraemia.

4. Loss of vision which sets in gradually can have a pathological foundation. Might be a chronic nephritis, but this occurs only occasionally.

5. If a detachment of the retina be found on examination, the treatment depends upon whether there be a severe chronic nephritis present or not.

In the first case the pregnancy should be terminated. In the second, treatment by rest in bed, etc., should be carried out.

6. The statement that retinitis of pregnancy is only found in cases where there is a chronic nephritis has been refuted. It is also found in the group of pregnancy toxaemias. Only in exceptional cases should one procure abortion early where there is a retinitis of pregnancy.

7. Retinitis of pregnancy shows a favourable prognosis as regards life, and a relatively favourable prognosis as regards sight.

8. The opinion of Adam, viz., cases of chronic nephritis which develop a retinitis of pregnancy have a bad prognosis, was not found to be correct in three cases in which this condition was met.

9. If the retinitis is diagnosed as a specific retinitis albuminurica, then abortion should be procured, as prognosis is bad both as regards sight and life.

10. The treatment recommended by Schiötz, that all cases of chronic nephritis in which there are fundal changes, should have the pregnancy terminated and the woman sterilized, is not justified, and should only be performed in severe cases.

S. SPENCE MEIGHAN.

BOOK NOTICES

Helmholtz's Treatise on Physiological Optics. Translated from the Third German Edition. Edited by JAMES P. C. SOUTHALL, Professor of Physics in Columbia University. Published by the Optical Society of America. Vol. I, pp. XXI, 482. 1924. Price, 7 dollars.

The first edition of Helmholtz's Physiologische Optik was published in 1866. Like his "Tonempfindungen" in acoustics, it marked an epoch in the history of the physiology of vision. The publication of the second edition began in 1885, but was still incomplete at the time of the author's death in 1894. It was completed by Arthur König, who added an invaluable bibliography. The completed edition was published in 1896. The third edition was published under the editorship of Nagel, von Kries, and Gullstrand. The first volume appeared in 1909, the third in 1910, and the second in 1911. In this edition it was determined to reproduce the text of the first edition. The reasons for this decision were, first, that "the whole imperishable significance of Helmholtz's achievements in the domain of the physiology of vision, the elegant physical methods which he adopted and improved, his painstaking observations of the sensations themselves and the allied psychical phenomena, the mathematical analysis and philosophical and critical discussion, all these characteristic features are essentially interwoven with the first edition of the Physiological Optics. It is the classical work that marked the dawn of a new era in the science of the physiology of the senses;" second, that "curiously enough the changes and additions which were introduced in the second edition seem to be called in question and discarded at present to a far greater exent than the contents of the first edition." There can be little doubt that the decision was wise, for it is generally conceded that, on the whole, Helmholtz did not improve his masterpiece, owing largely to the diversion of his interest into other channels. The editors of the third edition, while leaving the text of the first edition inviolate, added copious notes, bringing the subject up-to-date. These notes often expanded into long articles of the greatest value. The weakest part of the edition was that concerning visual perceptions, which is also the weakest part of the original treatise; but the book as a whole is still the standard work on Physiological Optics. Its nearest rival is probably the section on this subject in Nagel's Physiologie der Menschen, but as this was written for the most part by Nagel and von Kries it merely embodies a similar representation of the facts and theories in somewhat different form.

The first edition of Helmholtz's treatise was translated into French by Javal and Klein, published in 1867. No translation of the work has ever appeared in English. It was not, indeed, until the year 1900 that any comprehensive work on the subject appeared in the English language, in the form of a magnificent résumé in the article on Vision, by Rivers, in Schäfer's Text-Book of Physiology.

It cannot but be regarded as a slur on British Science that this monumental work has never been placed within the reach of English-speaking students in their own language. Even the almost equally remarkable, but on the whole less original and important work—the "Tonempfindungen"—found a translator in A. J. Ellis within 10 years of its publication in 1865. It does not alleviate our discomfort, though it enhances our debt of gratitude, that the translation should at last—60 years after the original publication—have been undertaken by the Optical Society of America. They have wisely decided to translate the complete third edition, including the editorial notes and supplements. They have, indeed, added some new and original material. The present volume contains a chapter on Ophthalmology by Professor Gullstrand, and we are promised further contributions by Professor von Kries and Dr. Christine Ladd-Franklin. There are also a few explanatory foot-notes. It is invidious to look a gift-horse in the mouth, but the samples of additional foot-notes in this volume are rather sketchy and for the most part not very illuminating. Thus on page 6 the "anterior homogeneous membrane" of the cornea is called the membrane of Descemet, and we are referred to a paper by Sasse in 1879 (!) to the effect that "the tissue of the anterior and posterior homogeneous membrane is not identical with elastic tissue." Such errors would have been obviated if a physiologist or an ophthalmologist had been included on the editorial board. The reviewer cannot claim to have studied the translation with great care, but a long experience of the original has made him conversant with the difficulties of an accurate translation, and whilst he is quite certain that few, if any, biologists could translate this work adequately without the help of mathematicians and physicists, he is of opinion that the editor—a very distinguished physicist and author of a standard work on Geometrical Optics—would have been wise to have collaborated with an authority on the specifically physiological aspects of the subject.

The manner in which the translation has been produced is worthy of all praise. It was an immense task to undertake, not merely from the point of view of the work involved, but also on account of the expense. We are given to understand that it was rendered possible only by the help and encouragement of Mr. Adolph Lomb, to whom we, in common with our American colleagues, offer our thanks. It is hoped that the remaining two volumes will be completed before the end of another year.

Körperstellung: Experimentell-physiologische Untersuchungen über die Einzelnen bei der Körperstellung in Tätigkeit tretenden Reflexe, über ihr Zusammenwirken und ihre Störungen. By R. MAGNUS. Berlin: J. Springer. Pp. 730, with 263 figures in the text. 1924.

The history of science is punctuated with epoch-making discoveries by great men. It is seldom that a man starts a line of experimental research which, by brilliant imagination, unflinching perseverance, and meticulous accuracy, he carries on from one discovery to another until he becomes the unique and universally acknowledged master in his particular field of work. For the past thirty years or more Sir Charles Sherrington has been working upon the physiology of the nervous system, with special reference to the reflex actions which form a fundamental characteristic of its activities. The delivery of the second course of Silliman Memorial Lectures at Yale University afforded him the opportunity of gathering together the results of his researches and showing their logical connexus in more striking manner than isolated papers in scientific publications could do. These lectures were published in book form in 1906 under the title "The Integrative Action of the Nervous System." It is doubtful if any book ever more rapidly acquired the status of a classic. During the course of his work Sherrington showed that it was possible to remove the whole of the cerebral hemispheres of higher mammals—dogs, cats, monkeys, etc. —and still keep the animals alive for a considerable period. He discovered that if this operation was done and the brain stem was trans-sected at the level of the posterior corpora quadrigemina, the limbs of the animal assumed a state of tonic extensor spasm. This condition he called decerebrate rigidity. Such an animal can be placed upon its feet and will continue to stand up indefinitely. But, as Magnus says, it is a "caricature of standing," for if it is pushed to one side, or even if its head is passively turned to one side, it immediately falls over, and it has no power of regaining the standing posture or even the normal posture of repose.

It is not surprising that these brilliant experiments should have attracted a number of young physiologists to work under the aegis of the master. Among them was Dr. R. Magnus of Utrecht. In 1909 he made the chance observation that when a decerebrate cat, whose spinal cord had been divided in the thoracic region, was turned over from lying on its side to lying on its back, the fore legs immediately assumed a condition of extensor rigidity. Professor Magnus and his collaborators, of whom the chief is Dr. de Kleijn, have during the past fifteen years worked steadily and logically at the laws governing postural reflexes of which this chance observation is an example. Their researches have appeared in various publications and are well known to neurologists. They have been gathered together in a

remarkably lucid and complete form in the book under consideration, a book which must inevitably assume an importance second only to its great precursor by Sherrington.

Fascinating as the subject is, it would not commend itself to extensive notice in a journal devoted to ophthalmology if it were not that variations in posture are accompanied by ocular manifestations. Ophthalmologists are for the most part occupied with those higher characteristics of visual activities which are concerned in conscious perceptions. They are liable to forget that vision is *the* projicient sensation *par excellence* in the higher mammals. In this respect it has usurped the position of the sense of smell—with marvellous results in the evolution of species. When animals with bilateral symmetry were evolved the head end became all important, and rapidly commandeered possession of the projicient sensory organs. It became imperative for the head to take control of the movements of the body, and in this control the projicient organs played the predominant part. In higher animals the visual reflexes concerned in posture and movements of the body are "automatic" and carried out unconsciously; hence they are liable to be overlooked and underestimated in dealing with visual functions.

It has been proved by Sherrington that the receptor element of the reflex in decerebrate rigidity is proprioceptive, *i.e.*, it originates in the sensory nerve supply of the muscles and tendons. The adequate stimulus is the actual tension or stretch of the muscles and tendons (Sherrington and Liddell), and if the corresponding posterior roots are divided the tone is abolished. Probably all postural reflexes are proprioceptive, but many are due to the otoliths in the labyrinths of the inner ears, the stimulus varying with the relations of the maculae of the saccule and utricle to the horizontal plane, maximum extensor tone being developed when the otoliths depend from, minimal when they rest upon, the maculae. Postural tonus of a muscle differs from muscular contraction due to exteroceptive stimuli in having a very long latent period and persisting indefinitely until inhibited by some other reflex.

Postural reflexes may be divided into two great groups—static and stato-kinetic. The former deal with changes in posture of the otherwise stationary animal; the latter with movements of the animal. The stato-kinetic reflexes are the more complicated, and in them the semi-circular canals play a large part, whereas only the otolith organs are involved in static labyrinthine reflexes.

Static reflexes are further divided into two groups—postural reflexes proper (*Haltung*) or standing reflexes (*Stehreflexe*), and righting reflexes (*Stellreflexe*). The standing reflexes are found in unadulterated form in the decerebrate preparation. Righting reflexes only occur in animals in which the transverse section of the brain stem passes more anteriorly—at least so far forward as to

preserve both quadrigeminal bodies in continuity with the medulla and spinal cord. Such a preparation is called a "mid-brain animal." The "thalamus animal" in which the section is still farther forwards, retaining the optic thalamus, but severing the connection with the cerebrum, including the corpus striatum, behaves almost the same as a "mid-brain animal," and is more easily investigated owing to the preservation of the centres for the control of body temperature.

Experiments on the decerebrate preparation show that there are tonic neck reflexes and tonic labyrinthine reflexes, and that when both are active the resulting effect is the algebraic sum. The tonic neck reflexes can be studied free from complication after bilateral extirpation of the labyrinths. Rotation of the head on the long axis (snout—foramen magnum), lateral flexion (*negation*), and dorsal and ventral flexion (*affirmation*) all produce characteristic responses. Thus, rotation to the right (right eye down, left eye up) causes increased extensor tone of the left limbs, diminished extensor tone of the right limbs. Lateral flexion to the right causes the reverse effects, but the former are more potent. Dorsal flexion reinforces extensor tone in all limbs in the rabbit, affects the fore and hind limbs reciprocally in the cat, increasing extensor tone in the former and inhibiting it in the latter. Ventral flexion has the reverse effects to dorsal flexion. The "affirmation" effects can be easily demonstrated in the intact cat. All these effects are abolished by section of the posterior roots of the first, second and third cervical nerves.

The tonic labyrinthine reflexes act both on the limbs and on the body musculature, but most strongly on the former. Generally speaking the labyrinthine reflexes act similarly on all four limbs, and are maximal when the animal is in the supine position and the line of the mouth (*e.g.*, cat) makes an angle of 45° above the horizontal, and are minimal when the animal is standing, with the line of the mouth at an angle of 45° below the horizontal.

These standing reflexes are accompanied by *compensatory eye movements*. The tonic labyrinthine ocular reflexes are exhibited when the position of the head in space is altered, and consist of vertical and rotatory deviations. If the head is rotated to the right (right eye down, left eye up) the right eye moves upwards and the left eye downwards. If the head is rotated upwards around the bitemporal axis the eye undergoes torsion such that the top of the vertical meridian of the cornea moves forwards towards the nose. It will be seen that the labyrinthine reflexes are of such a character as to retain the visual field so far as possible in its normal orientation: but in no case is this effect fully accomplished. The effectors of the labyrinthine ocular reflexes are the superior and inferior recti and the obliques. The lateral recti play no part.

The tonic ocular reflexes initiated in the neck muscles are demonstrated in lateral flexions (*negation*) of the head. When the head is turned to the right the right eye turns forwards (towards the nose), the left eye backwards. Here too the eye movements are compensatory, and the lateral recti are involved.

The combined effects of the neck and labyrinthine reflexes are almost completely compensatory, so that the orientation of the field of vision is maintained in spite of the (passive) movements of the animal. When active movements of the animal occur stato-kinetic labyrinthine reflexes are set in action by changes in velocity owing to stimulation of the semicircular canals. These also lead to vertical, horizontal, and rotatory deviations. "These reactions are such that with a given movement of the head of an animal which is in the normal posture the eyes are moved into the position in which they will later be maintained by the static reflexes, so that they are deviated into the necessary direction at the very beginning of movement."

"There is therefore an extraordinarily well-developed correlation of ocular labyrinthine and neck reflexes, by means of which, both in movement and at rest, and in the various physiologically possible positions of the head with respect to the body and in space the correct visual attitude and the suitable correlation of the two eyes are ensured."

The mid-brain animal behaves very differently from the decerebrate animal. Walshe (*Brain*, Aug., 1924), sums up its chief characteristics as follow: "After the operation is complete the anaesthetized animal is laid on its side. As it emerges from anaesthesia, it raises its head, the fore part of the trunk follows, then the hind part, and finally the animal assumes a squatting position. The distribution and intensity of muscle tone is normal throughout, and there is no rigidity. Such an animal is an automaton deprived of all volition, and whatever activity it shows is purely reflex. All the normal nutritional reflexes and many pseudo-affective reflexes are present. It jumps when a loud noise is made in its neighbourhood. If such an animal be laid upon its side or back, it rights itself at once. Under appropriate stimulation it can step, run and jump with perfect co-ordination, and when its movements cease it resumes the sitting posture. In whatever position the animal be placed, the head at once rights itself, and the animal clearly is in possession of reflex reactions which keep the head always right side up in the world, and since the position of the head governs that of the trunk and limbs it has reflex control over all its postures. The following groups of "righting reflexes" (for so Magnus favours the anglicizing of *Stellreflexe*) have been analyzed: (1) Labyrinthine reflexes acting upon the head; (2) reflexes arising in the body wall and acting upon the head; (3) reflexes arising in the neck secondary

to (1); (4) reflexes arising in and acting upon trunk and limb musculature; and (5) in the intact animal a fifth group of righting reflexes arising in the retinae. When the labyrinths are both destroyed and the animal is blindfolded it loses the capacity of righting the head in space. When vision is free it is able to do so, even after bilateral labyrinth extirpation. Optic righting reflexes are present in cat, dog, and monkey, but not in guinea-pig or rabbit."

The fifth group of righting reflexes occurs only in those animals which have some degree of binocular vision, and then only in the intact animal. They differ therefore fundamentally from all the other reflexes, in that they are subserved by the cerebral cortex (probably the visual cortex). After bilateral extirpation of the cerebral hemispheres dogs, cats and monkeys behave exactly like rabbits and guinea-pigs. "If both labyrinths are extirpated in these (intact) animals, and they are held up free in the air (to avoid reflexes arising in the body wall) a short time after the operation, the head is disoriented and can be kept in any desired position in space. After a few days, however, the animals learn to use their eyes for orientation, and one can then see clearly that if any object—food, the observer, or objects in the room—is fixated, the head turns into the normal posture. After a few days the animals have usually developed this capacity well, so that if one now, *i.e.*, with intact cerebrum and open eyes, examines them free in the air, the head assumes the normal posture as soon as any object is fixated.

That the effect is really due to optical righting reflexes is shown by the fact that the capacity immediately disappears if the eyes are blindfolded; the animals heads are now just as disoriented as is the case with labyrinthless rabbits and guinea-pigs."

It is impossible in a short review to do justice to this fascinating book. It is written in simple German and is very easy to read. It is beautifully illustrated by stereoscopic and other photographs, which err only in being on a rather small scale.

Lighting in Relation to Public Health. By JANET HOWELL CLARK, PH.D. Baltimore: Williams and Wilkins Company (Agents Baillière, Tindall & Cox). Pp. 185 with 67 text illustrations. 1924. Price 4 dollars.

The author, who is the Associate Professor of Physiological Hygiene of the Johns Hopkins University, has in this volume given a condensed account of the course given by her at the School of Hygiene and Public Health of the University to classes composed largely of students studying for the degree of Doctor of Public Health. The first three chapters deal with light sources and the methods of measuring them. The account of the various photometers suitable for this type of work is clear and excellent and easily

understood without any special technical knowledge. The next three chapters deal with reflectors, sufficient illumination, and glare. The author then describes the best conditions for visual efficiency, the lighting of schools and factories, and other interior and exterior illumination. The last four chapters are devoted to a short account of the various eye complaints attributable to under or over illumination and heat, and the means of protection to be adopted. The author duly acknowledges the numerous figures taken from the *Transactions of the Illuminating Engineering Society* as well as numerous valuable and interesting figures and tables from the bulletins of the Engineering Department of the National Lamp Works of the General Electric Company. The chapter, all too brief, on the best conditions for visual efficiency gives a clear account of the work of Ferree and Rand on the measurement of ocular fatigue, and the summary is worth quoting at length: "1. Visual acuity, as tested by letter charts, increases with illumination and reaches a maximum at about five foot-candles. 2. Speed of discrimination increases rapidly up to two foot-candles and after that more slowly, but is still increasing at eighteen foot-candles. Therefore, although five foot-candles is sufficient for clear discrimination of test objects, it is not sufficient to insure the greatest speed of discrimination of the same objects. For occupations where speed of vision is an important factor illuminations as high as twenty foot-candles are desirable. 3. For the best visual discrimination the surrounding field should be the same brightness as the object visualized, therefore general illumination is to be preferred to local illumination. 4. To avoid eye fatigue one must avoid bright lights in the field of view. The eye fatigues least under the following systems in order of preference: (*a*) total indirect, (*b*) semi-indirect with dense globe, (*c*) direct with filament hidden and brilliant lining of reflector dulled at the edge to reduce its glare."

In the chapter dealing with diseases attributed to light and heat the author quotes some recent work of her own on the coagulation of egg albumen by ultra-violet light (*Amer. Jl. of Physiol.*, Vol. LXI, p. 72, 1922) which lends some support to Burge's theory on the causation of lens opacity. This whole chapter should be read in the original and is very suggestive. Recent work is carefully analyzed and an account is given of the Report of the Miners' Nystagmus Committee, as also of the recent papers in this journal by Healy, Cridland and St. Clair Roberts on cataract in tinplate millmen, iron smelters and chain makers. We cannot agree with the author in one statement on myopia in which she says: "In a poor light a book is held closer to the eye and the pressure on the eyeball, due to binocular accommodation, is greater than normal." We presume that binocular convergence is meant.

The book should fill a much needed place and should be in the library of all Public Health Officers. The print, paper and make-up of the book reflect great credit on the publishers, but they are rash enough to print two end pages headed "*Sans Tache*," giving the list of all their composers, proof-readers, etc., and saying that their ideal is to publish books without a blemish. Needless to say, we have not read the book for misprints, but we note that on page 66 figure 39b should read curve B in figure 39, and on page 134 powerful is spelt without an r.

NOTES

Dr. Alfred Enke

THE September-October number of the *Klinische Monatsblätter für Augenheilkunde* gives a portrait of Dr. Alfred Enke, together with a brief note of congratulation to him on completing 50 years as manager of the publishing firm that has brought out the journal since the year 1863. The journal, which, as our readers are well aware, has always taken a foremost place in ophthalmic literature, is much indebted to Dr. Enke for the sustained excellence of its production over such a lengthy period. He has been elected Doctor of Medicine, *honoris causa*, by the University of Tübingen.

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La Societe belge d'Ophtalmologie

THE Belgian Ophthalmological Society have recently issued a circular giving a preliminary note on the arrangements for the Annual Congress of the French Ophthalmological Society to be held by special invitation at Brussels from the 9th to the 14th of May, 1925. Those wishing to take part are requested to communicate as early as possible with Dr. Danis, 7, Rue Montoyer, Brussels. The secretaries of the reception committee are Professor van Duyse and Dr. Danis. The subscription has been fixed at 60 Belgian francs. Subscribers will receive a copy of the Transactions. The entertainment programme will be settled later.

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Appointments

MR. S. D. LODGE has been appointed Honorary Ophthalmic Surgeon, Leeds General Infirmary.

Mr. A. F. MACCALLAN has been appointed Assistant Ophthalmic Surgeon to the Westminster Hospital and Assistant Surgeon to the Royal Eye Hospital.

Ophthalmological Society of Egypt

THE Annual Meeting of the Ophthalmological Society of Egypt will take place at the School of Medicine, Examination Room, Students' Club, Cairo, on March 6th, 1925.

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R.L.O.H. Dinner

THE Annual Dinner of Past and Present Students of the Royal London Ophthalmic Hospital will be held at the Langham Hotel, Portland Place, on Thursday, February 12, 1925, at 7 for 7.30 o'clock; Chairman, Mr. W. T. Holmes Spicer. Tickets (excluding wine, 15s.) may be obtained from Sir William Lister (24, Devonshire Place, W.1), or Mr. Charles Goulden (79, Portland Place, W.1), secretaries.

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Erratum

IN Mr. A. S. Percival's paper on "Prescribing Spectacles" in the January number on p. 13, Table 1st line for 1.0031 read 1.0931.

FUTURE ARRANGEMENTS

1925.

February 3.—Midland Ophthalmological Society, at Birmingham.
February 6.—North of England Ophthalmological Society, at Liverpool.
February 13.—Section of Ophthalmology, Royal Society of Medicine. (Discussion on Miners' Nystagmus.)
March 6.—North of England Ophthalmological Society, at Sheffield.
March 13.—Section of Ophthalmology, Royal Society of Medicine (Clinical).
April 7.—Midland Ophthalmological Society, at Leicester.
May 8.—Section of Ophthalmology, Royal Society of Medicine.
May 9-14.—Congrès de la Société française d'Ophtalmologie, at Brussels.
June 2.—Midland Ophthalmological Society, at Oxford.
June 12.—Section of Ophthalmology, Royal Society of Medicine (Annual).
July 14-17.—Convention of English-speaking Ophthalmological Societies, in London.
July 17-25.—British Medical Association, at Bath.
October 6.—Midland Ophthalmological Society (Annual), at Birmingham.